

REMARKS

The Board's Decision in the above-referenced application has been received and reviewed. The Examiner's final rejections of claims 33-37 and 41-56 were affirmed by the Board. Independent claims 33, 43, and 49, as well as the claims that depend therefrom, have been amended.

Reconsideration of the above-referenced application is respectfully requested.

Claim Amendments

In addition to amending independent claims 33, 43, and 49, all of the dependent claims that remain pending in the above-referenced application have been amended to replace "said" with the equivalent term "the." As these are equivalent terms, it is respectfully submitted that these revisions do not narrow the scope of the claims.

Rejections under 35 U.S.C. § 103(a)

Claims 33-37 and 41-56 have been rejected under 35 U.S.C. § 103(a) for being directed to subject matter that is allegedly unpatentable over the subject matter taught in U.S. Patent 5,672,542 to Schwiebert et al. (hereinafter "Schwiebert").

The standard for establishing and maintaining a claim rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Schwiebert teaches a method of using a stencil to form solder bumps on substrates. Col. 1, lines 9-14. Specifically, Schwiebert teaches placing a solder mask 326 with multiple

apertures 330 onto a substrate 320. The apertures 330 of the solder mask 326 correspond to the locations of wettable regions 322 (i.e., contact pads) on substrate 320. Col. 6, lines 25-33; FIGs. 3A - 3D. A dollop of metal paste is “squeegeed” into the mask 326 apertures 330. Col. 7, lines 66-67; col. 8, lines 1-2; FIG. 3B. The solder paste is a metal powder mixed with a flux vehicle. Col. 8, lines 18-19. “The mask aperture 330 dimensions are generally (but are not required to be) somewhat larger than the dimensions of the wettable regions 322.” Col. 7, lines 50-53. The solder paste is re-flowed by heating the entire substrate 320, mask 326 and solder paste assembly. Col. 9, lines 53-55; FIG. 3C. As with any conventional solder mask, upon heating the assembly, the solder paste metal spheres 334 melt and coalesce into a single sphere or solder bump 338. Col. 9, lines 55-57.

An additional requirement of Schwiebert is that the stencil surface and, in particular, the surfaces of the apertures 330 must not be wettable. Col. 7, lines 11-16. In other words, as the solder paste is liquified during the re-flow process, the formed solder bump 338 is repelled by the side walls of the aperture 330. *Id.* the mask (i.e., apertures) serves two purposes by acting as a reservoir for the metal paste to be deposited and to “act as a dam . . . to contain the paste until and during the reflow process.” Col 6, lines 40-45.

Schwiebert also teaches a bump-to-mask clearance given by the equation $c = (L - D)/2$, where L is the aperture 330 size and D is the re-flowed solder ball diameter. Col. 5, lines 44-52. Schwiebert illustrates the meaning of the bump-to-mask clearance equation in FIG. 1B and FIG. 3C, which depicts c as being the distance between an aperture 330 sidewall and the closest point on the surface of the solder bump 338. The surface to bump distance is greater than zero and, thus, the bumps 338 of Schwiebert are spaced apart from the sidewalls of the apertures 330 because Schwiebert teaches that there must be a minimum allowable bump to mask clearance for adequate stencil release, which is illustrated in FIG. 1B as c and is further supported by the preferred values for c provided in the table of mask/substrate/bump parameters. Col. 5, lines 64-65; col. 6.

It is respectfully submitted that Schwiebert does not teach or suggest each and every limitation of any of independent claims 33, 43, or 49.

Independent claim 33, as amended and presented herein, recites a pre-formed solder mask that includes “at least one open aperture” that includes “a surface configured to maintain contact with and form a peripheral shape of a conductive structure . . .”

Independent claim 43, as amended and presented herein, is drawn to a pre-formed solder mask with at least one aperture that includes “a surface configured to maintain contact with and define a peripheral shape of a conductive structure . . .”

Independent claim 49, as amended and presented herein, is directed to a semiconductor device assembly including a pre-formed film of solder mask material and at least one aperture formed through the pre-formed film. The at least one aperture is “configured to form a peripheral shape of a conductive structure.”

In contrast to the solder mask of Schwiebert, which includes apertures that are configured to repel solder, the structures to which amended independent claims 33, 43, and 49 are directed include at least one aperture with a surface that is configured to maintain contact with (independent claims 33 and 43) or form a peripheral shape of a conductive structure (independent claims 33 and 49).

Moreover, by teaching a solder mask that is configured to repel conductive material disposed within apertures thereof rather than to maintain contact with or form peripheral shapes of conductive structures, it is respectfully submitted that Schwiebert teaches away from the subject matter recited in independent claims 33, 43, and 49. As such, it appears that any motivation to modify teachings from Schwiebert in such a way as to render the subject matter of independent claims 33, 43, and 49 obvious could only be based upon improper hindsight.

Therefore, it is respectfully submitted that a *prima facie* case of obviousness has not been established against any of independent claims 33, 43, or 49 and, thus, that under 35 U.S.C. § 103(a), each of these claims recites subject matter that is allowable over the subject matter taught in Schwiebert.

Claims 34-37, 41, and 42 are each allowable, among other reasons, for depending directly from amended independent claim 33, which is allowable.

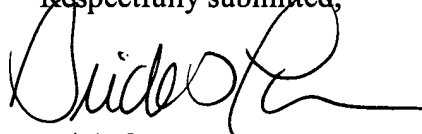
Each of claims 44-48 is allowable, among other reasons, for depending directly from independent claim 43, which is allowable.

Claims 50-56 are each allowable, among other reasons, for depending directly from amended independent claim 49, which is allowable.

CONCLUSION

It is respectfully submitted that each of claims 33-37 and 41-56 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Brick G. Power", written over a horizontal line.

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